NEW YORK SOCIETY FOR GASTROENTEROLOGY & ENDOSCOPY
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NEW YORK COURSE
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The Diagnosis is Colon Cancer – What are the Surgical Interventions?

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Disclosures

- Virtual Incision, MIRA Robot

Overview
Surgical Management of Colon Cancer

- Workup
- Surgical Options
- Operative Planning- Technical Considerations
- Robotic Colon Resection
- Results
- ERAS
- Opioid Free Anesthesia

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Workup: Staging

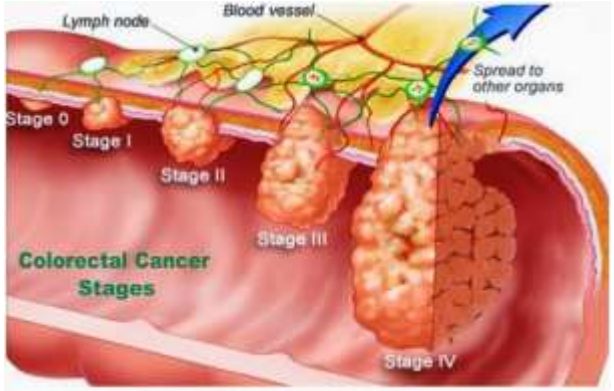
- CT C/A/P
- CEA Level

Consider Neoadjuvant Therapy

- Chemo or Immunotherapy
- Patients with locally advanced disease
- Patients with Metastatic disease

Preoperative CT C/A/P + IV + PO Contrast

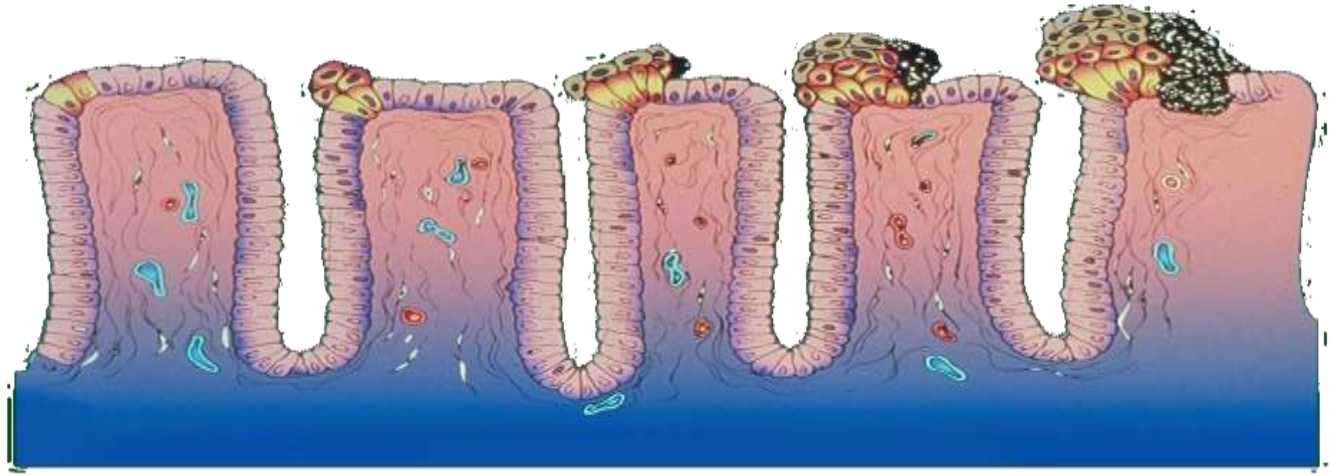
- Frequently used to evaluate for intrabdominal metastatic disease
- Reported accuracy in detection of liver metastases
  - > 1 cm is 90-95%
- If T4 aids decision making and OR planning
  - HBP, GU, GYN



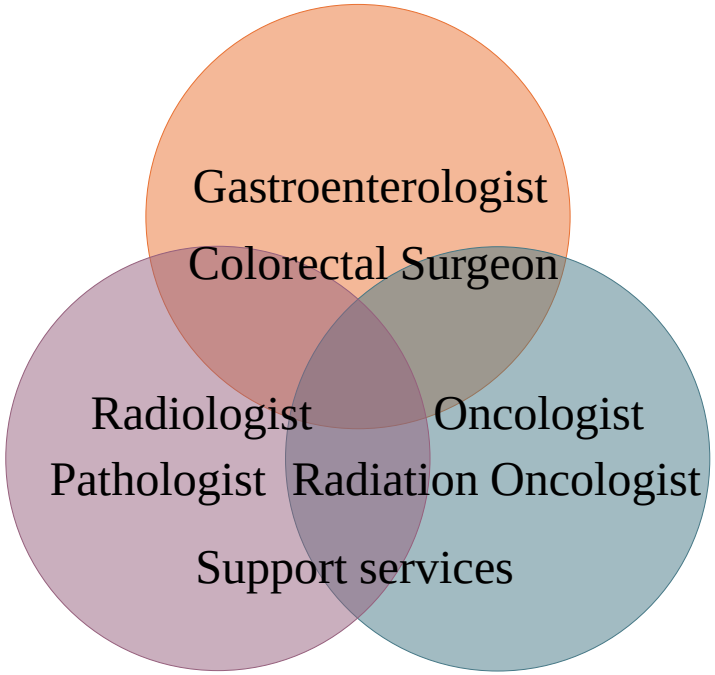
- Consider MRI if mass in pelvis, local invasion, rectosimgoid
- Consider PET CT if further clarification necessary

Preoperative CEA

- Recommended before and after surgery
- Normalization helps to confirm complete tumor resection
- Elevated preoperative CEA levels are associated with worse prognosis



Colon Cancer Treatment
Multidisciplinary Team Approach



Goals of Surgery for Colon cancer

- Curative
- Remove all disease (Ro)
  - Primary tumor
  - Lymph nodes

- Symptomatic relief (palliation)
  - Obstruction
  - Bleeding
  - Pain

- Preserve Quality of Life

N2Y
NEVER TOO YOUNG
FOR COLON CANCER

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Operative Planning

Technical Considerations

- Tumor Location
- Patients Surgical History
  - Ex. Mesh
- BMI
- T4: Local Invasion Other organs
- Proximity to Ureter

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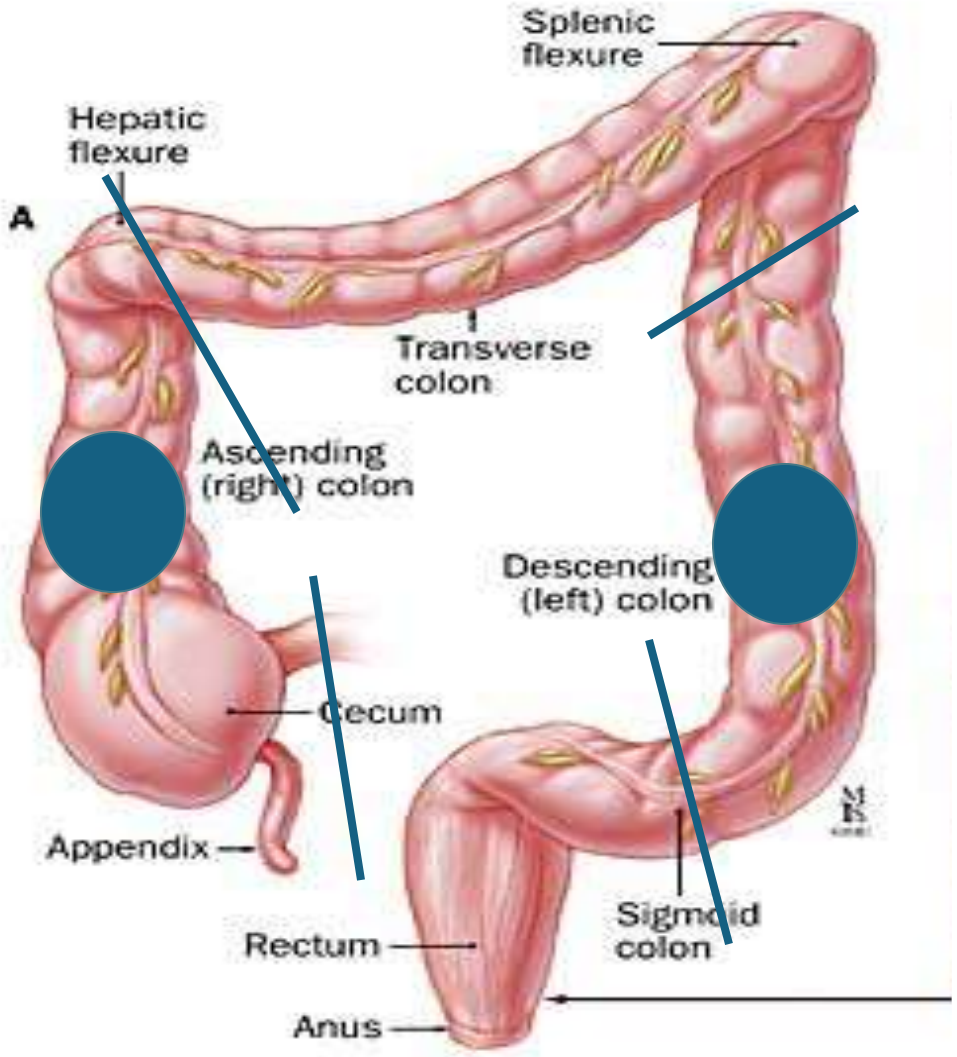
Surgery for Colon Cancer: Segmental Resection



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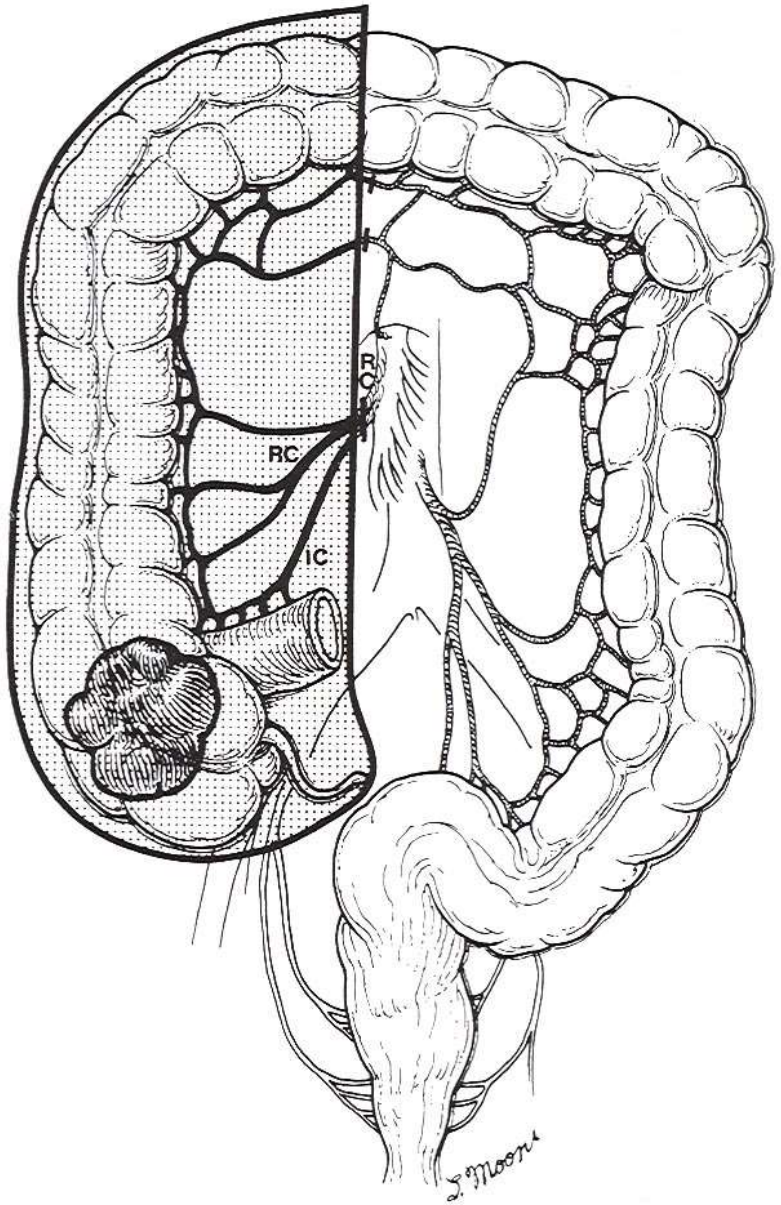
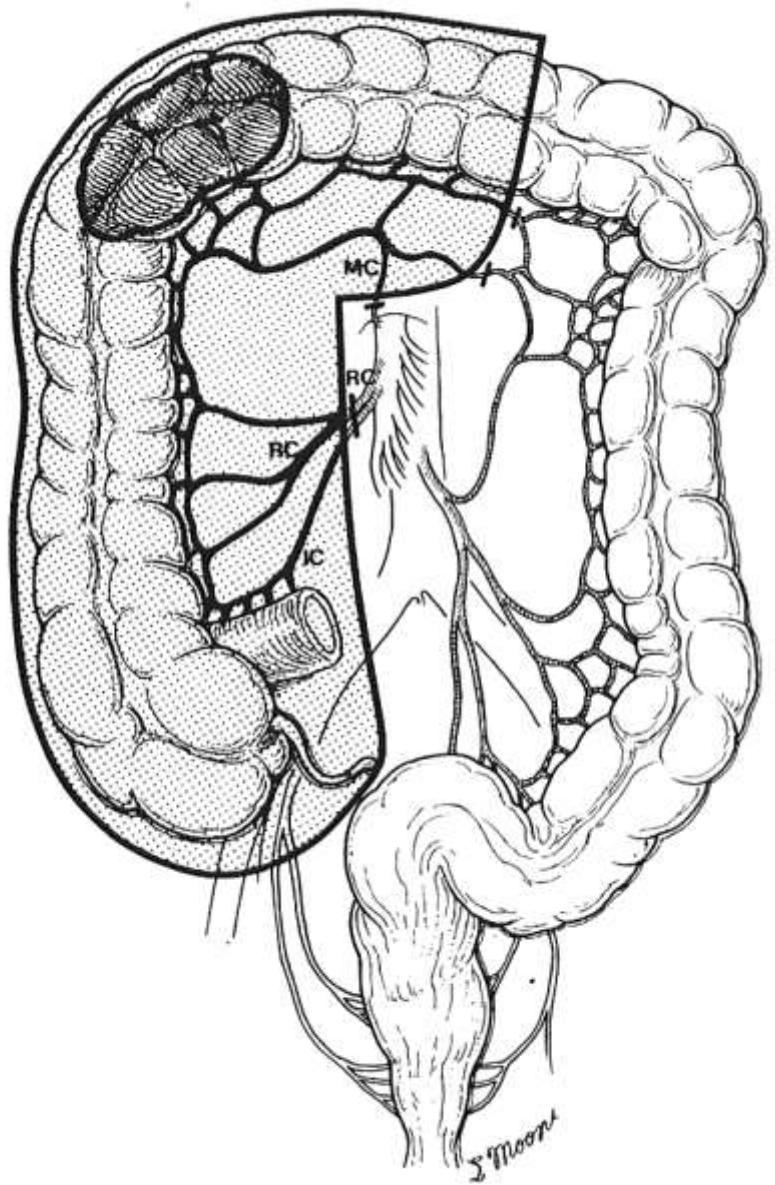
Right Hemicolectomy



Extended Right Hemicolectomy



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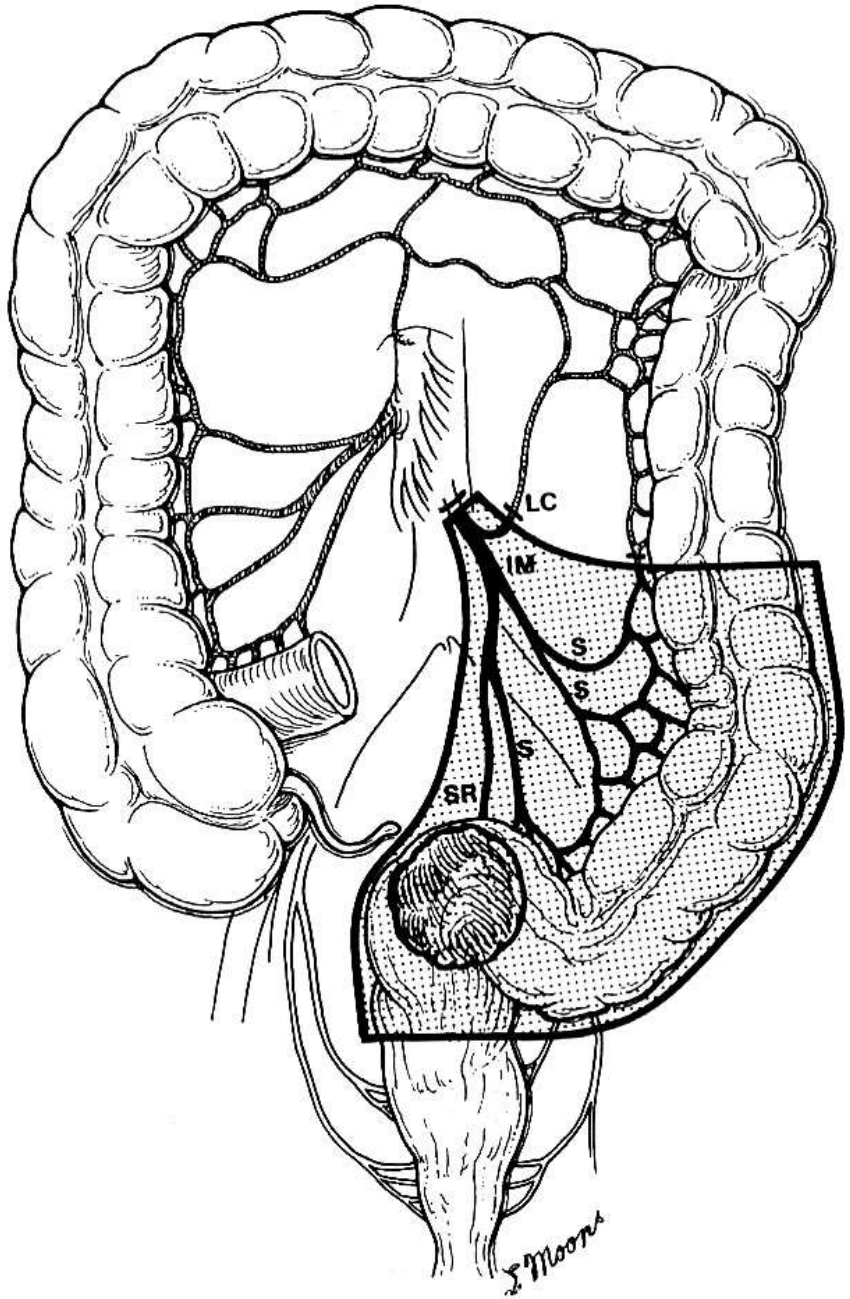
Sigmoid Resection



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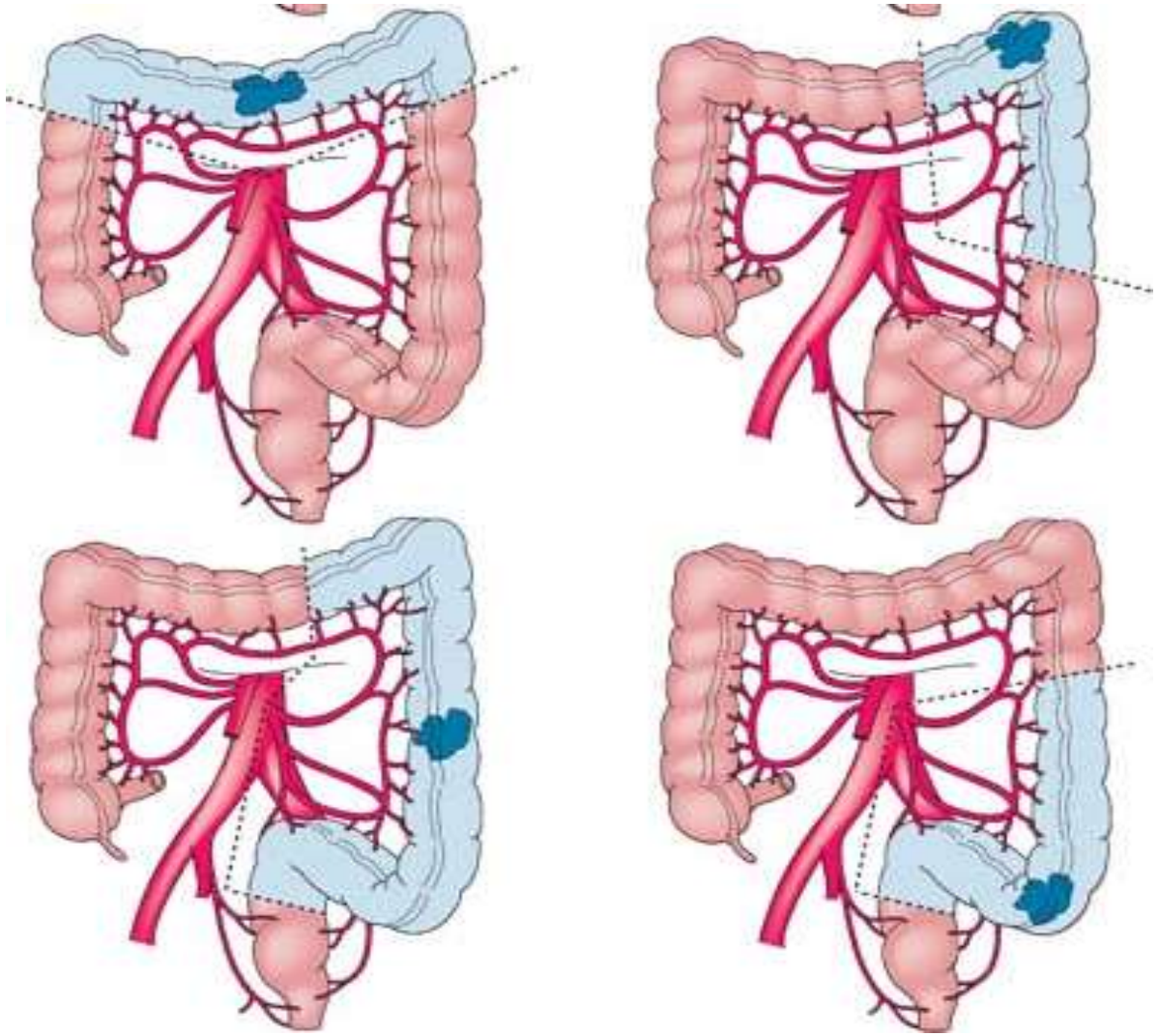

Left Hemicolectomy

Greenfield's Surgery: Scientific Principles and Practice, 5th Ed.

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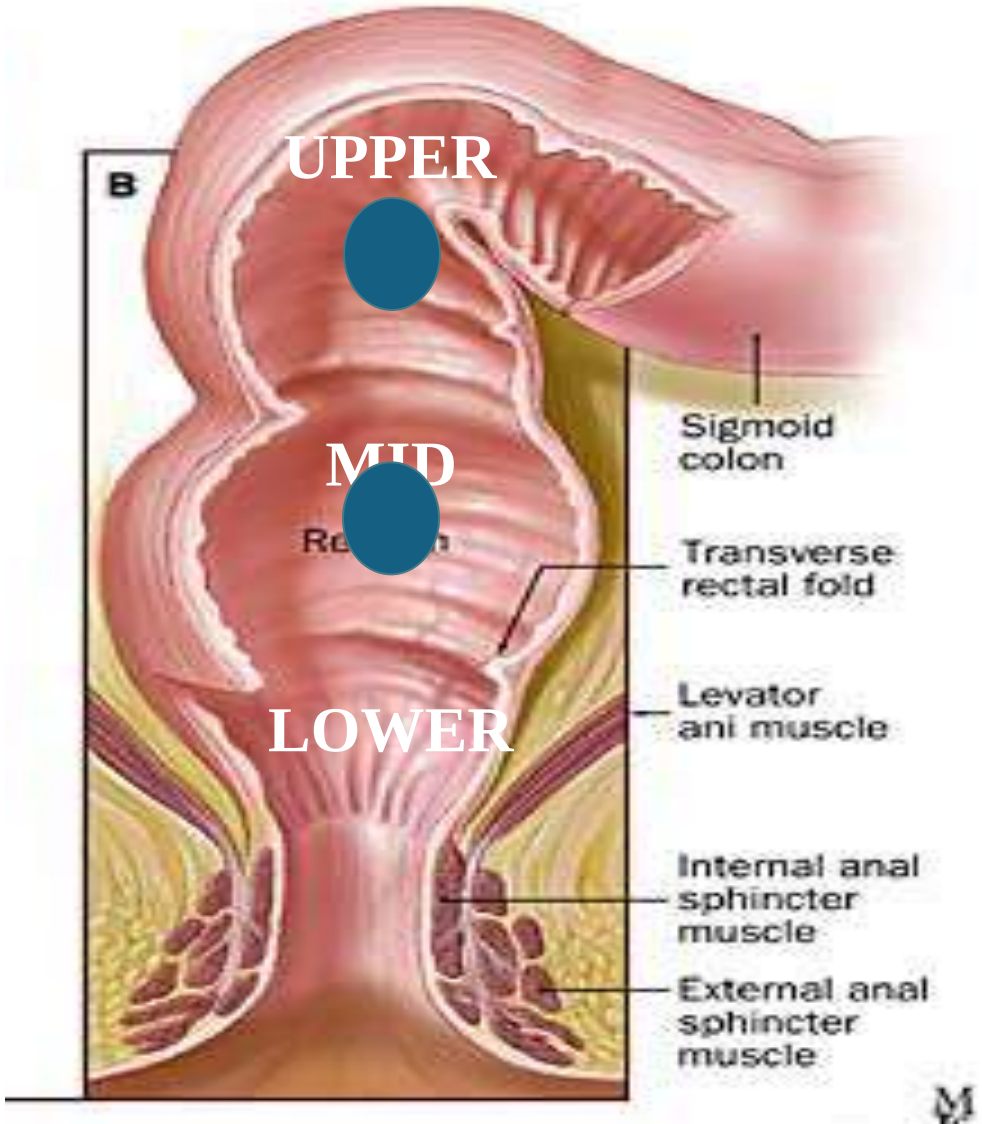
Surgery for Rectosigmoid or upper rectal cancer: Anterior (Rectosimgoid)Resection



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Preoperative

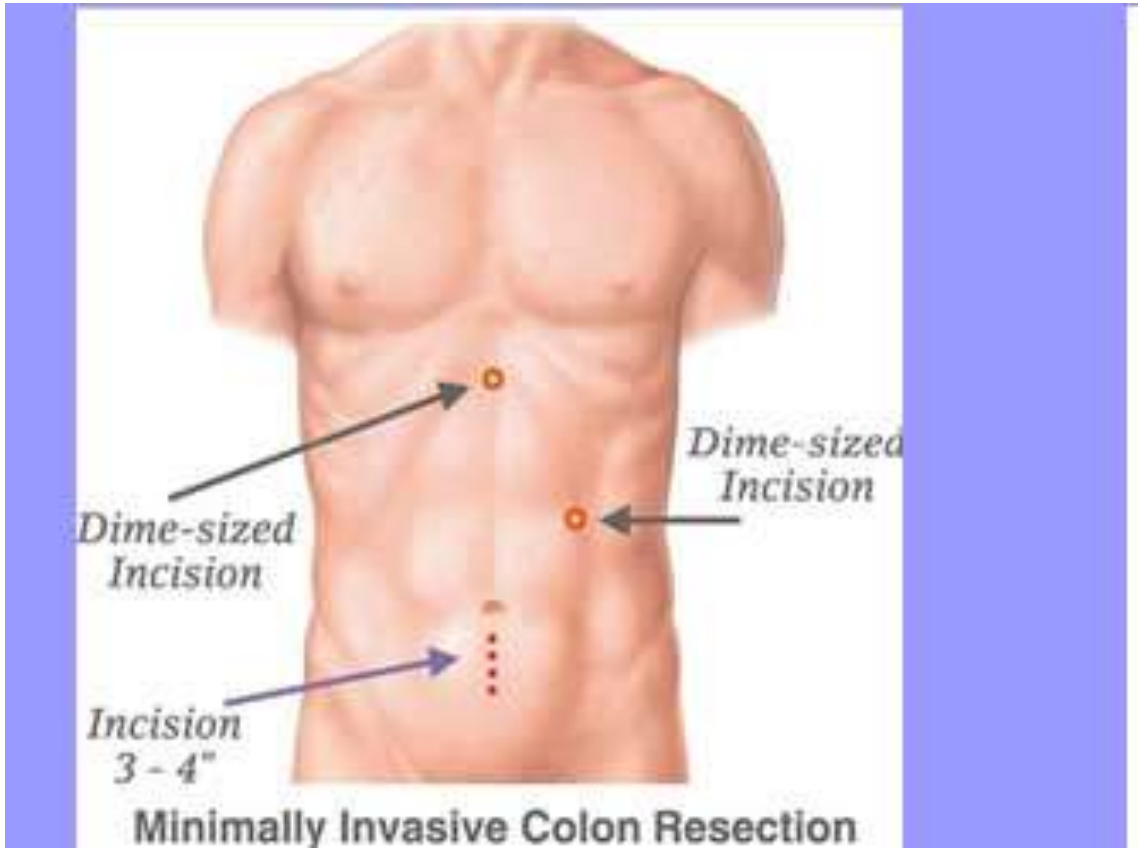
- Appropriate Staging Workup
- MDT Discussion
- +/- Neo Adjuvant Treatment
- Patient Counseling
- Mechanical + Antibiotic Bowel Preparation
- Antibiotics
- DVT Prophylaxis
- +/- Rectal Irrigation

Surgical options for acute colonic obstruction

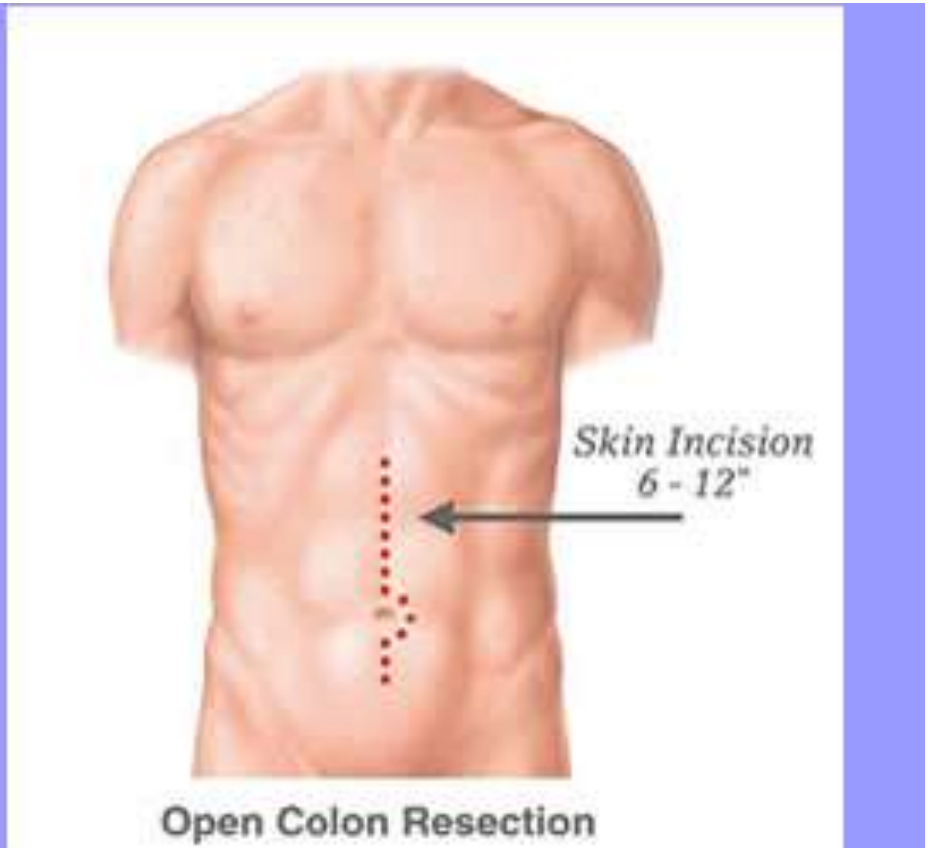
- Hartmann's procedure
- Resection of dilated colon and ileocolic anastomosis/ IRA
- Primary anastomosis with proximal diversion
  - On-table colonic lavage
- Colonic Endoscopic Stent Palcement
  - Converts to elective resection
  - Increases chance minimally invasive operation
  - Decreased chance diverting ostomy required

Surgical Approaches

Minimally Invasive



Open



Laparoscopic

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Robotic

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Benefits of Minimally Invasive Surgery (Laparoscopic & Robotic)

- Smaller incisions (cosmesis)
- Less postoperative pain
- Shorter hospital stay
- Faster recovery- Faster Return to Life/work
- Rates of cancer recurrence are no different

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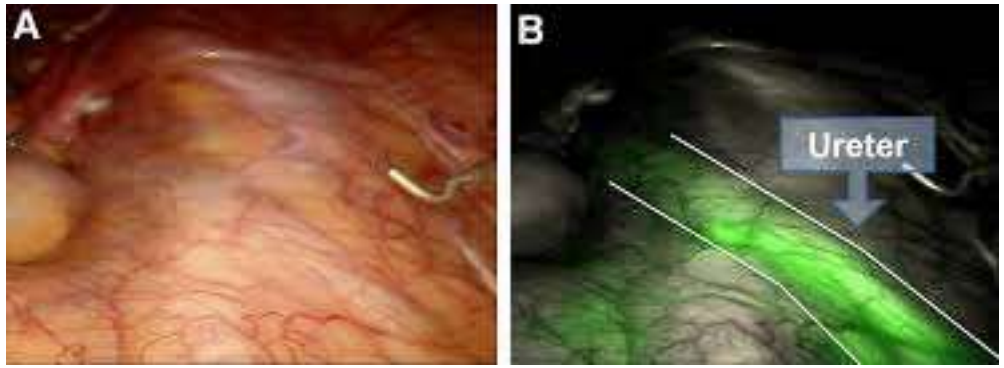
Robotic Colon Resection

- Da vinci Xi revolutionized the ability to do multi-quadrant surgery
- Can easily work from the splenic flexure to pelvis in 1 dock
- Flex joints- thinner
- Enhanced dexterity with wristed instruments
- 7-degrees of freedom, 90 degrees of articulation

- 3 D view & stable camera platform
  - Don’t need to rely on asst for camera
- Additional working arm – like operating with 3 arms
- Instruments with multiple functions in both hands
- Port hopping for camera for different views/exposure
- Table motion also improves efficiency

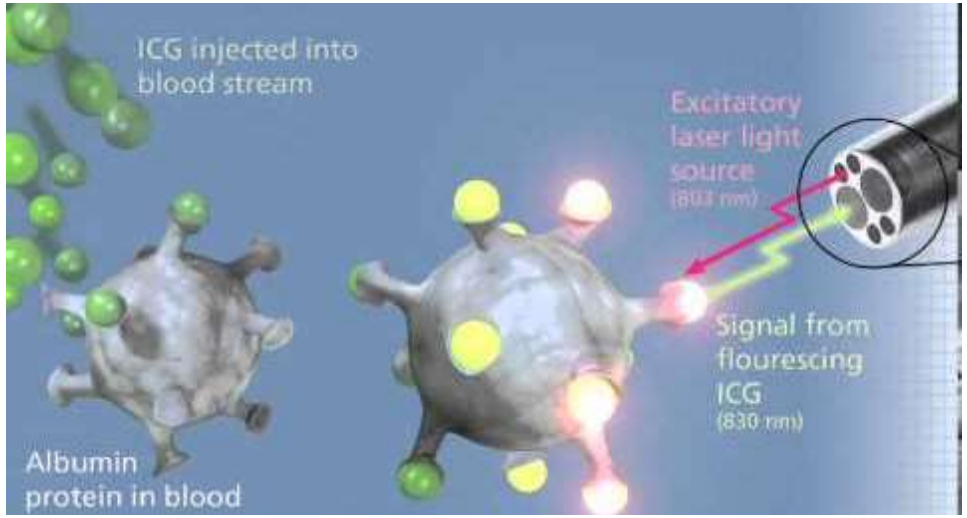
Robotic Advantages in Colon Cancer Surgery

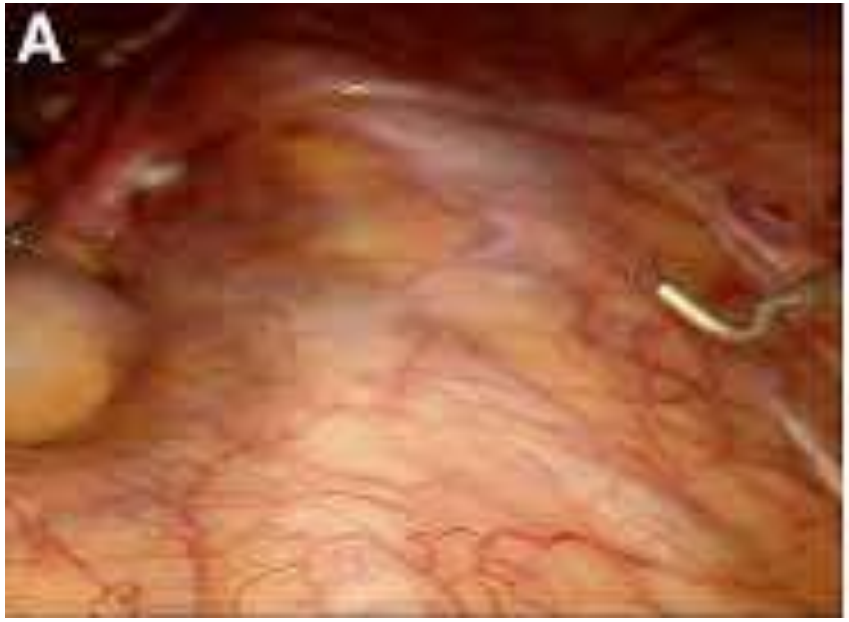
- 3D HD visualization
- Increased dexterity, wristed instruments
  - Avoids 2D “Straight Sticks” or “Crab Claws”
- Wristed energy devices
  - vessel sealer & fenestrated bipolar
  - Staplers
- Fluorescence imaging technology ICG
- Intracorporeal Anastomosis (ICA)
  - Joining Bowel Inside
  - Avoids Large extraction incision

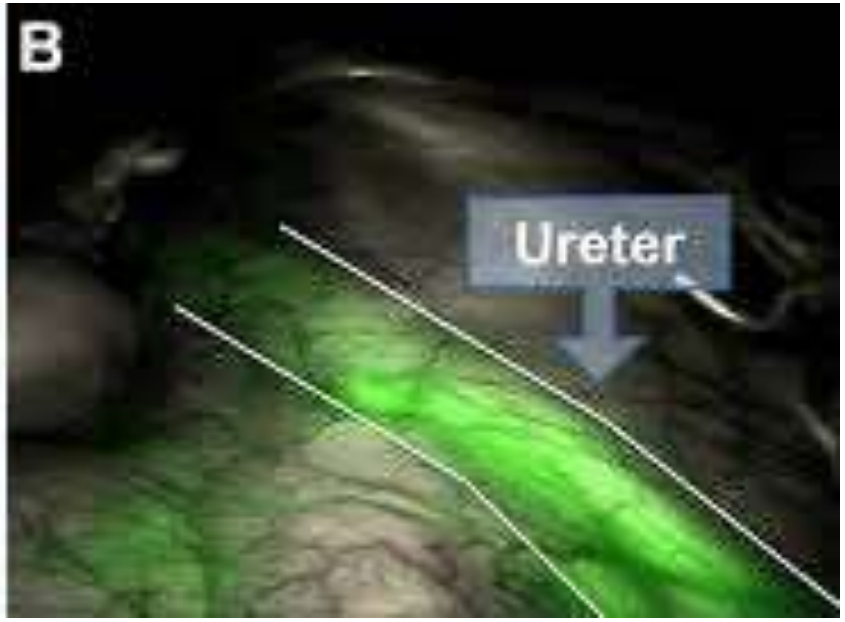


Visualize Ureteral stents with Firefly

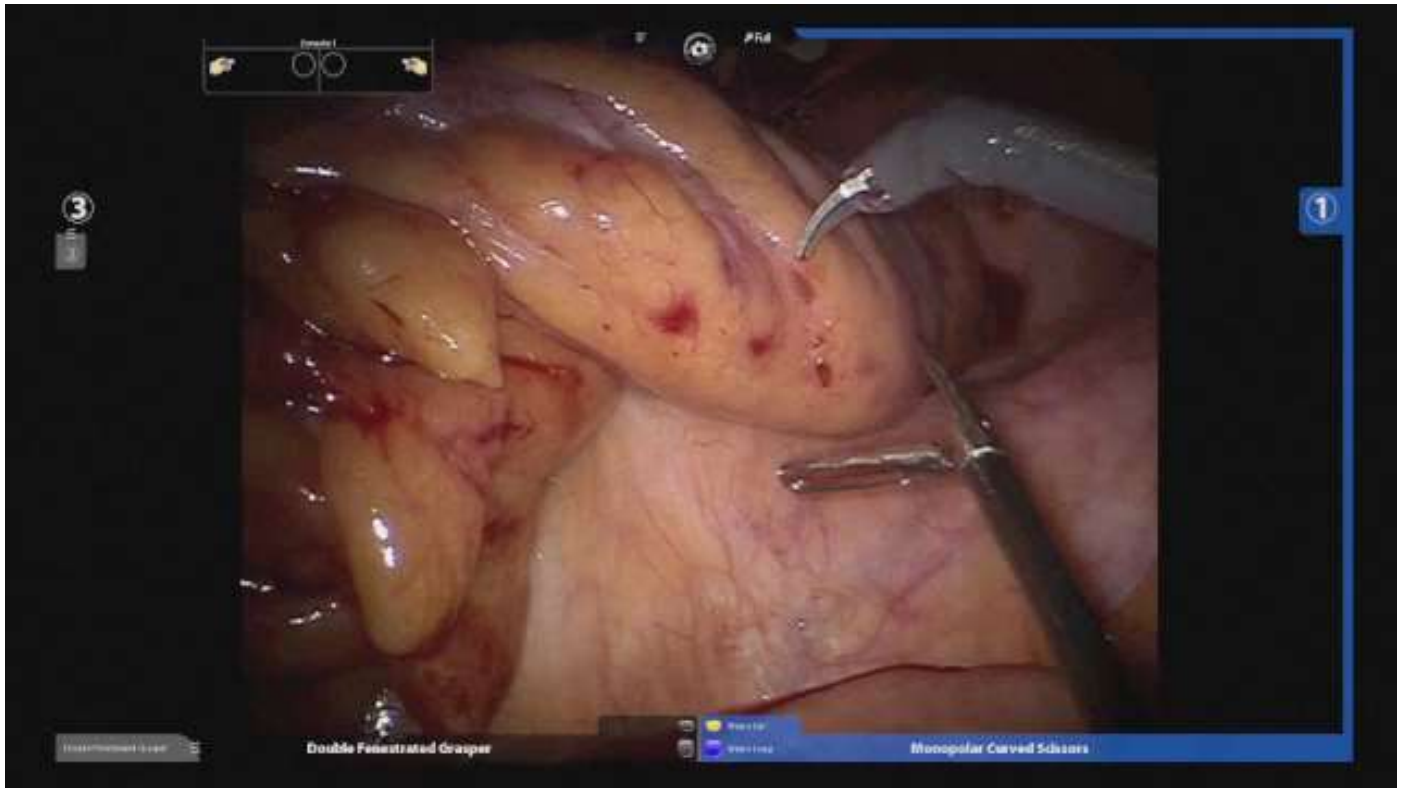
- ICG Injection up stent







IMA/IMV Pedicle



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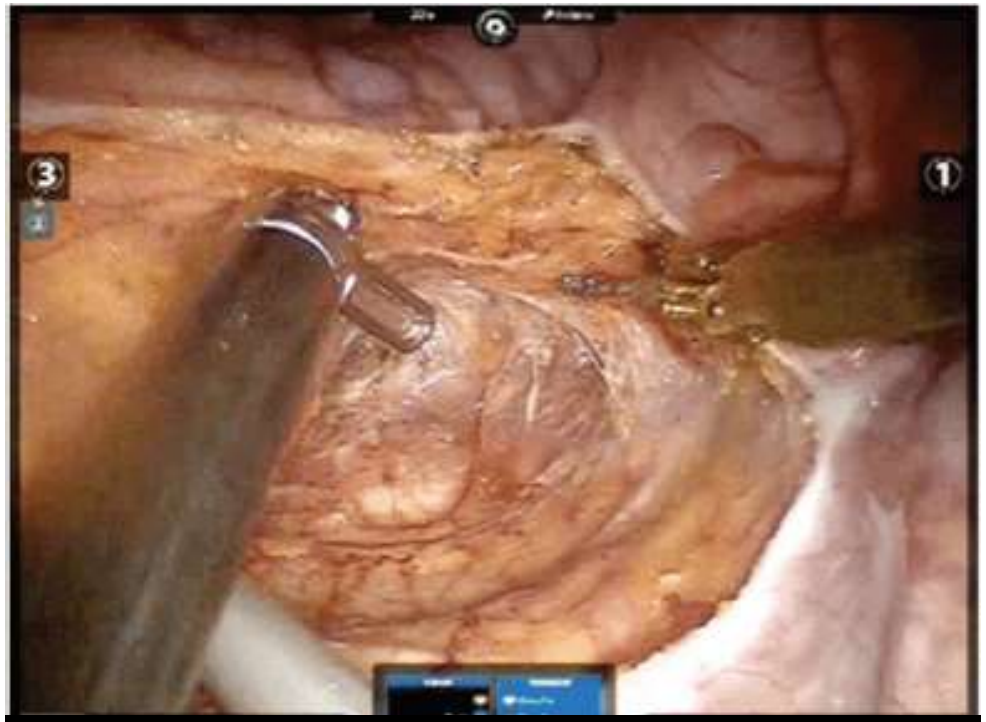
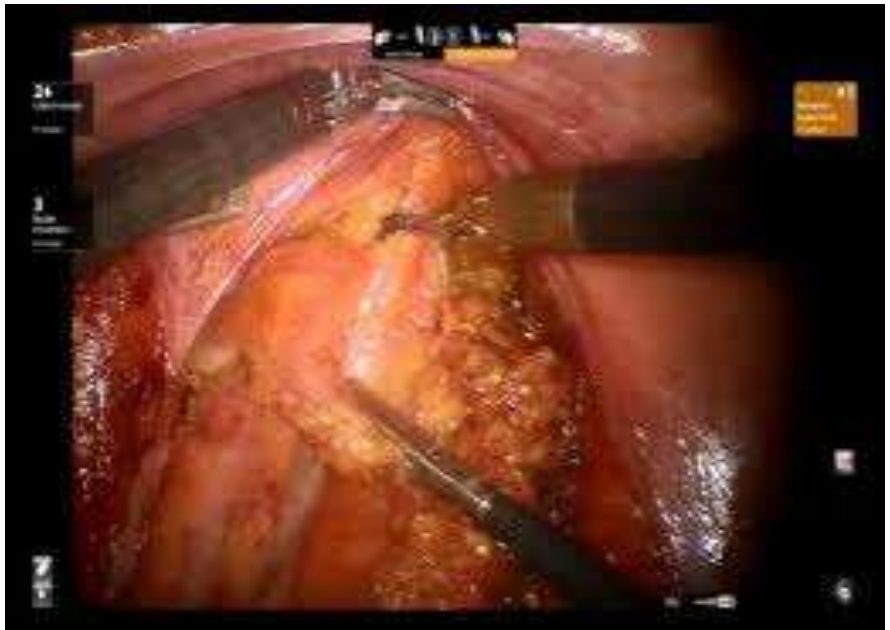
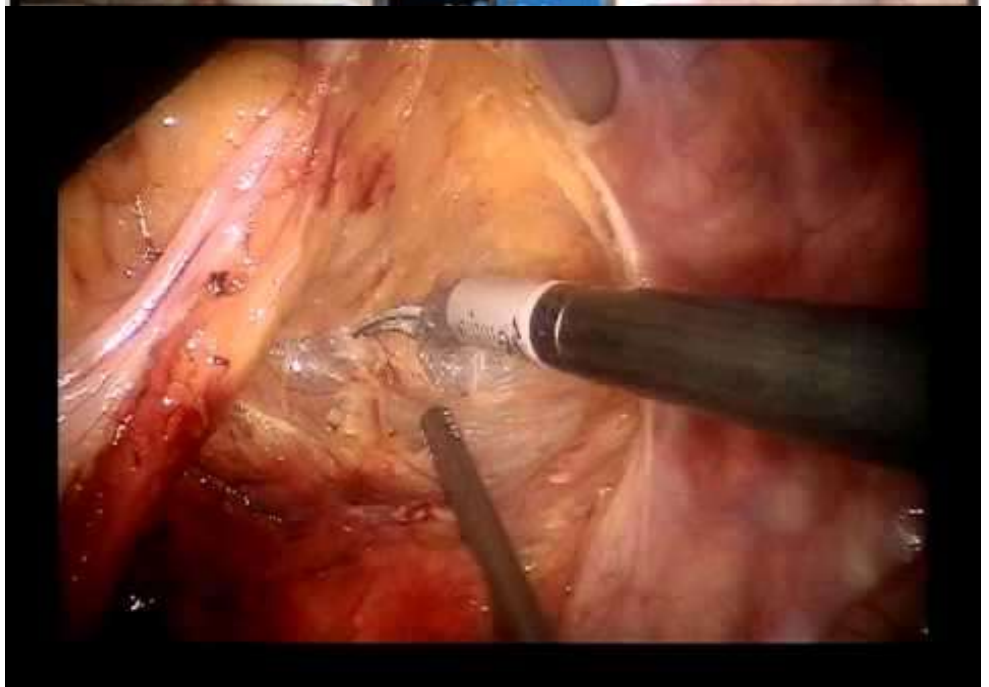
Pelvic Dissection







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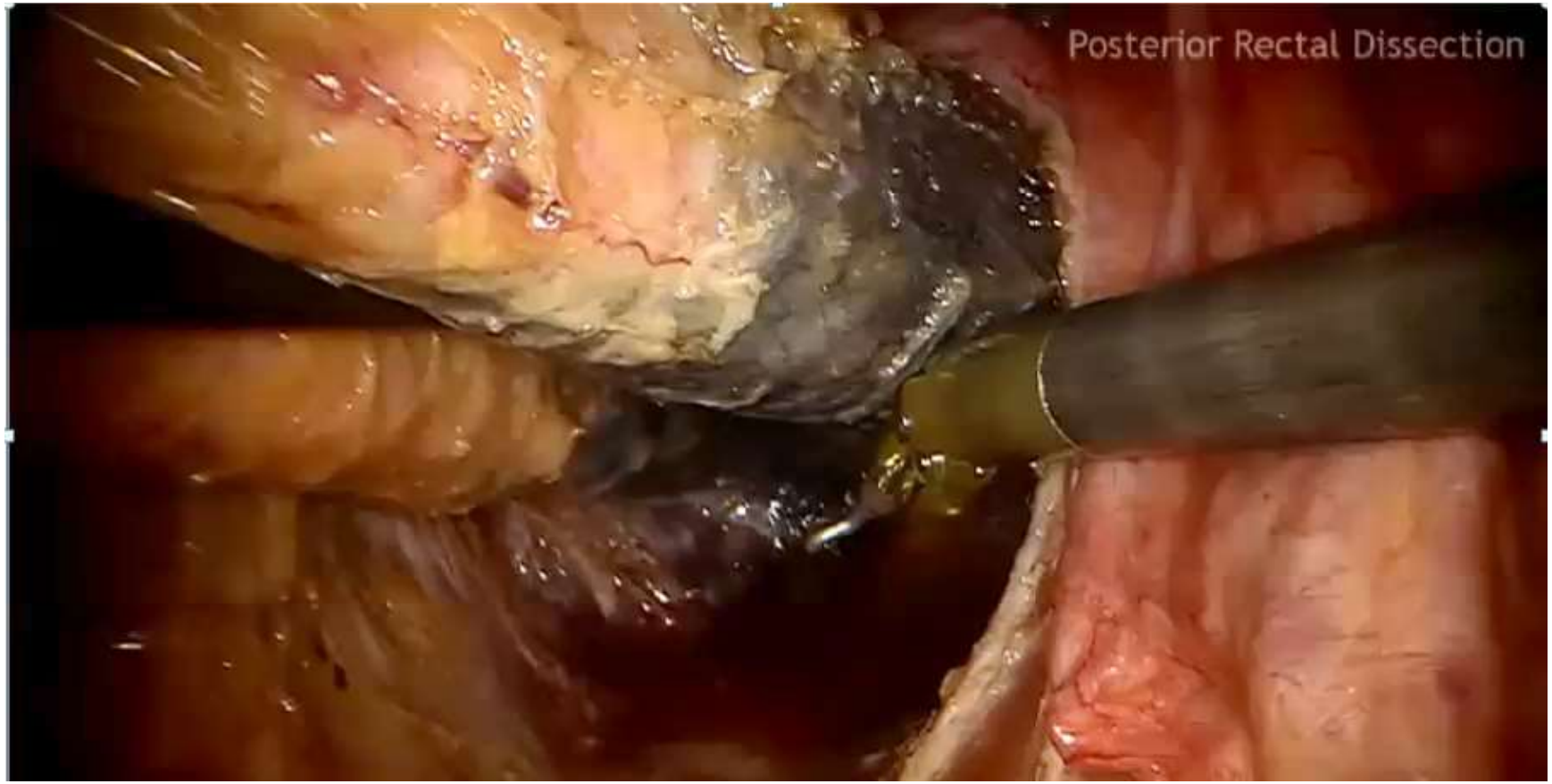
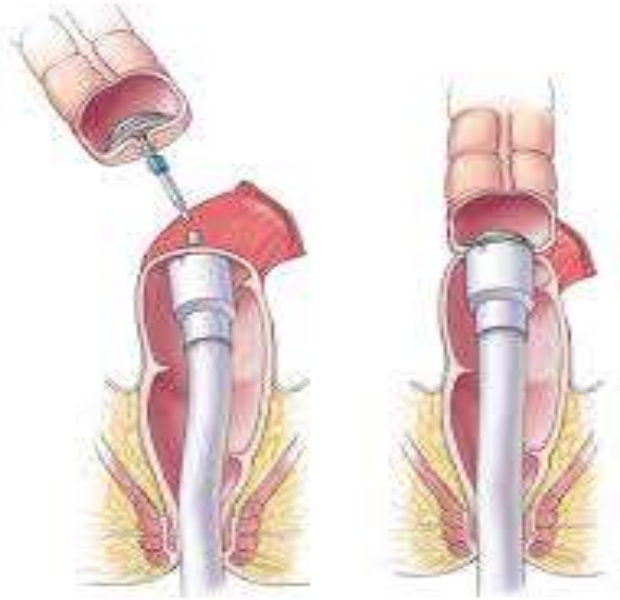
Low Pelvic Dissection



Robotic Advantage: Dissection & Stapling

- Useful for LAR or IPAA

Extraction & Anastomosis



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Robotic Right Hemicolectomy ICA

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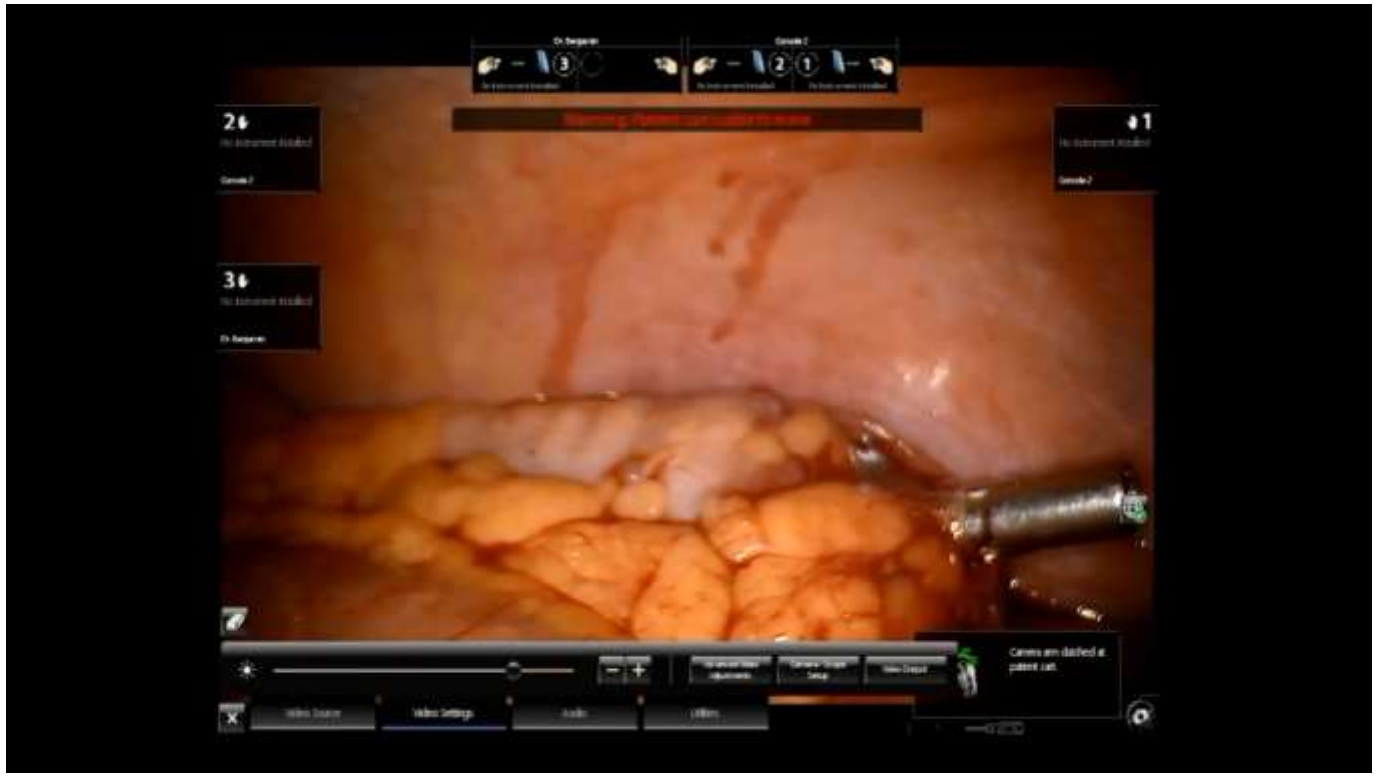
Firefly: Improve Quality & Prevent Leaks



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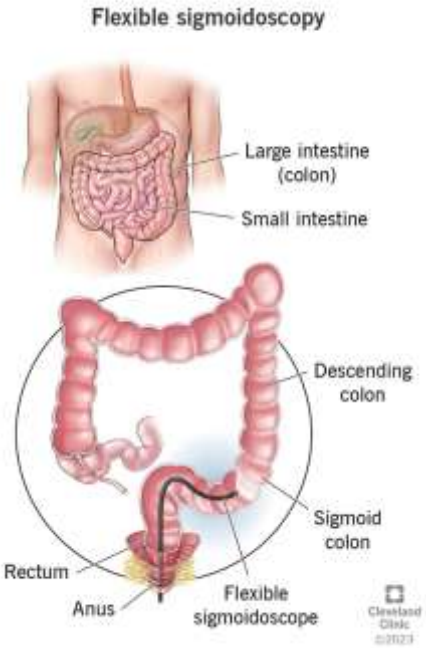
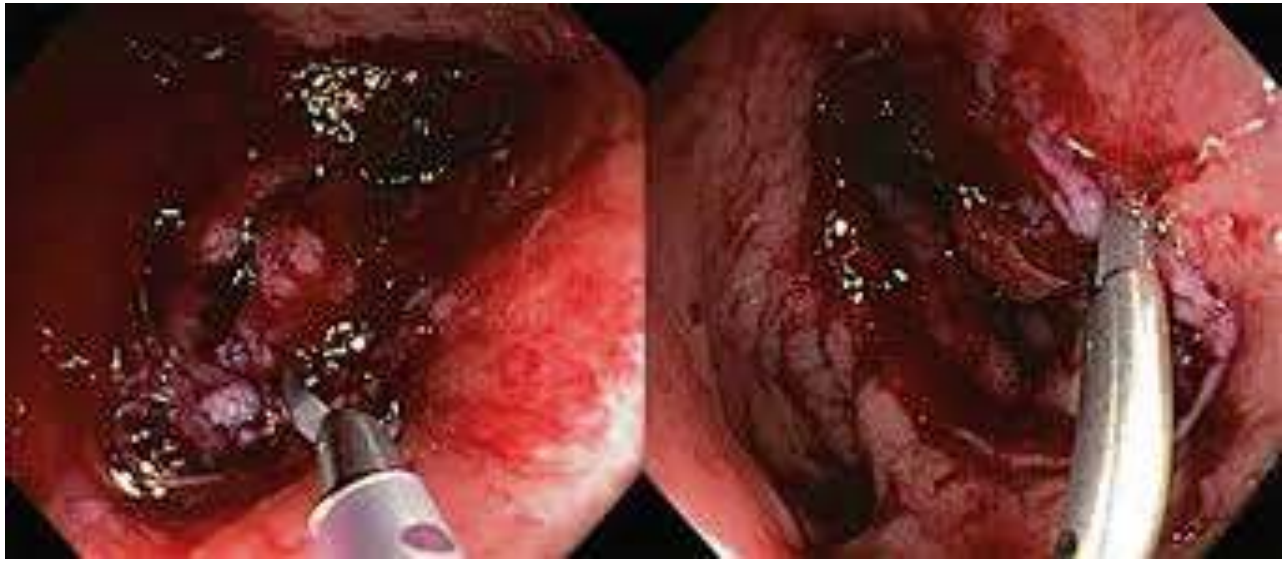
Anastomosis Quality Control



- Firelfy- Check perfusion

- Left side - Flex Sig:
  - Check for air leak
    - Target repair
  - Assess for Bleeding
    - Clip or Suture



Surgery for Colon cancer
Immediate Postoperative Risks

- Cardiac
- Pulmonary
- DVT/PE
- Bleeding
- Infection: Wound, Abscess
- HAP: UTI, PNA, C.Diff
- Ureteral Injury
- Enterotomy
- Anastomotic leak

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Surgery for Colon cancer
Long Term Postoperative Risks

- Leak, Enterotomy
  - Ileostomy Colostomy (+/-permanent)
  - Multiple Operations
  - IR drainage
  - Delay Chemotherapy

- Small Bowel Obstruction
- Stricture

- Erratic Bowel Habits (rare, usually resolve)
- ICV Syndrome: Frequency, Diarrhea

- Hernias

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Robotics in Colon Cancer Surgery

- Minimally Invasive Resection Rates Remain Low
- Open Surgery is still most common technique in the U.S.
- Laparoscopic Utilization:
  - Colon 44.8%[1-2]
  - Rectum 10.2%[3]

1. Fox J., et al, Diseases of the Colon and Rectum. 2012 55:5
2. Damle RN., et el., JACS 2014; 218:1223-1230.
3. Halabi et al., World J of Surg. 2013; 37:2782-90

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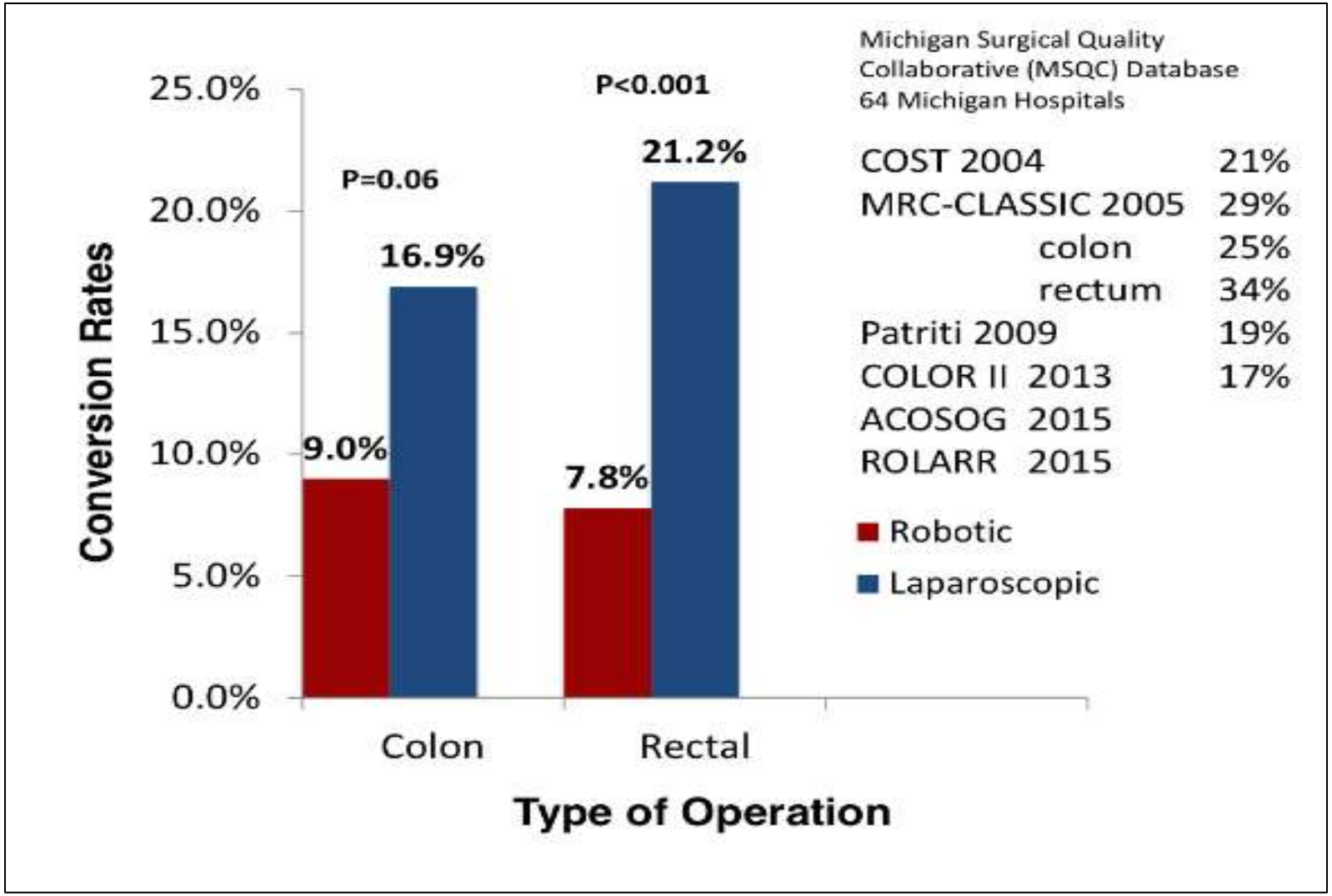
Robotics is Enabling More Minimally Invasive Colon & Rectal Surgery: Less Conversions to Open



Tam Ms et al., A population-based study comparing laparoscopic and robotic outcomes in colorectal surgery. Surg Endosc 2105
iCourtesy of: Robert Cleary, MD

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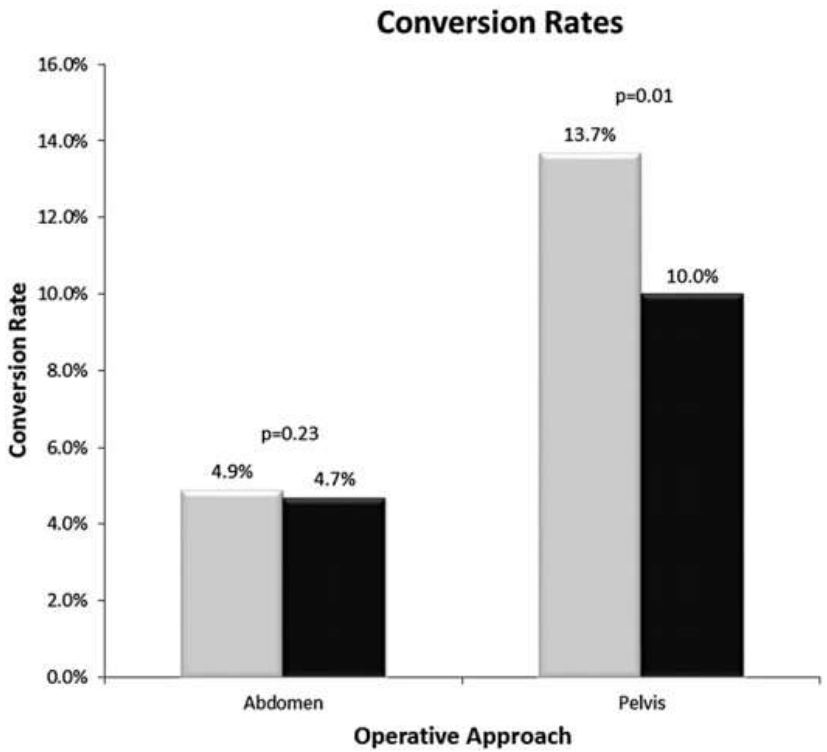
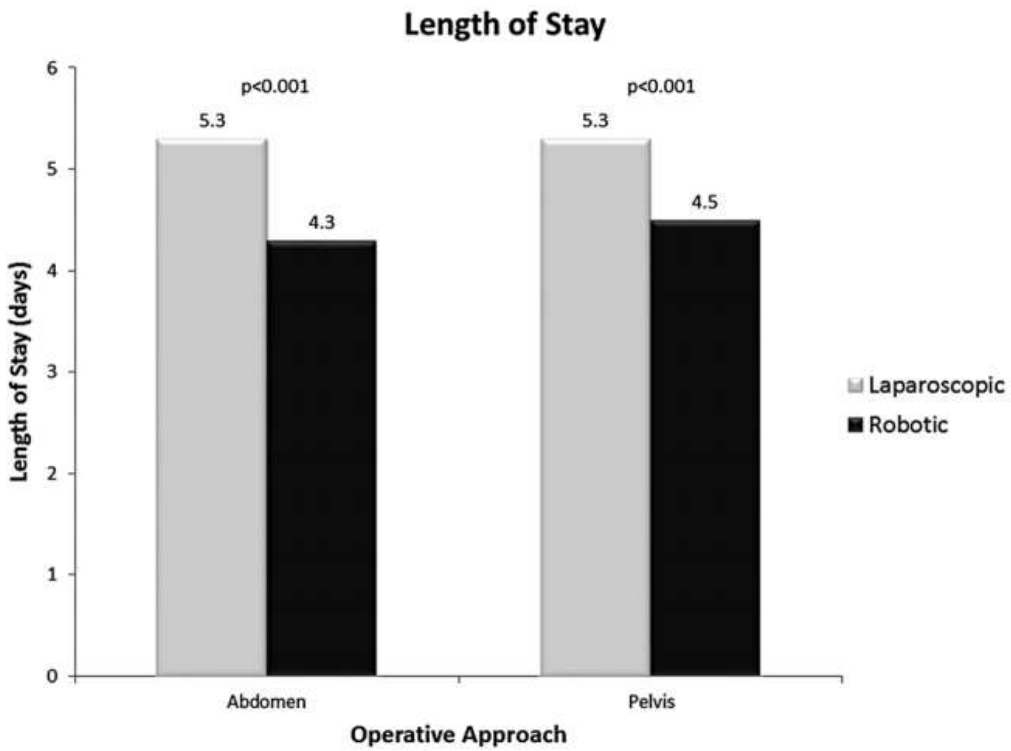
A comparison of laparoscopic and robotic colorectal surgery outcomes using the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database

Anuradha R. Bhama[1] · Vincent Obias[3] · Kathleen B. Welch[2] · James F. Vandewarker[1] · Robert K. Cleary[1]

Surg Endosc
DOI 10.1007/s00464-015-4381-9

ACS-NSQIP Database N=11,477





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The effect of surgical approach on short-term oncologic outcomes in rectal cancer surgery

NCDB Database
N=8,712

Emily F. Midura, MD,[a,b] Dennis J. Hanseman, PhD,[a,b] Richard S. Hoehn, MD,[a,b] Bradley R. Davis, MD,[a] Daniel E. Abbott, MD,[a,b] Shimul A. Shah, MD,[a,b] *and* **Ian M. Paquette, MD,[a,b]**
Cincinnati, OH

(*Surgery* 2015

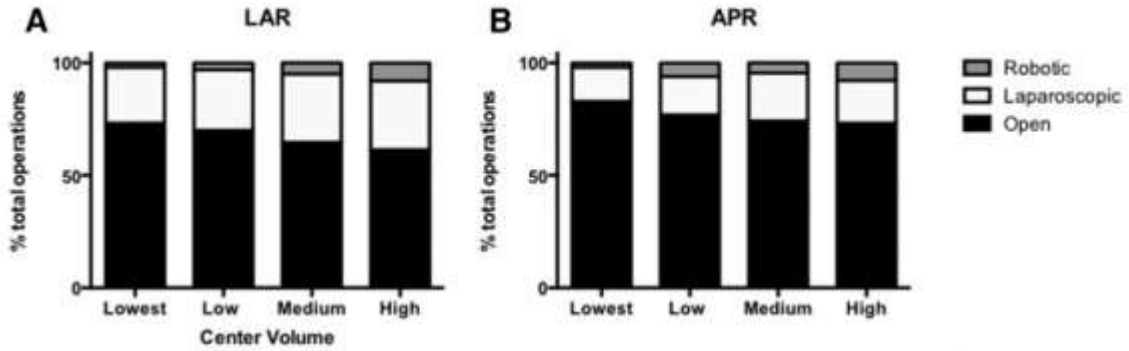

Table II. Univariate analysis of outcomes associated with operative a

Outcomes	*All cases*			
	Open	*Laparoscopic*	*Robotic*	P *value*
Oncologic outcomes (*n*)	5,935	2,337	440	—
LN harvest ≥12	65.8%	68.5%	69.1%	.04
Surgical margins				.002
Negative	92.8%	94.9%	95.4%	
R1 resection	6.8%	5.0%	4.4%	
R2 resection	0.4%	0.1%	0.2%	

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Postoperative and Oncologic Outcomes

- Meta- Analysis & Prospective Study Data
- Lap vs. Robotic Proctectomy: No Significant Differences
  - Complications
  - Circumferential margin
  - Distal resection margin
  - Lymph node yield
  - Length of stay

- Advantages:
  - Significantly lower conversion rates
  - True in obese pts., distal rectal tumors, and patients with Neoadjuvant CRT
  - Regardless of the experience of the surgeon

Memon S, et al., Robotic versus Laparoscopic Proctectomy for Rectal Cancer: A Meta-analysis. Ann Surg Oncol 2012; 19:2095–2101
Scarpinata R, Aly EH. Does robotic rectal cancer surgery offer improved early postoperative outcomes? Dis Colon Rectum 2013; 56: 253-262

ROLARR Trial Results

Robotic vs. Lap LAR for Rectal Cancer

RObotic versus LAparoscopic Resection for Rectal Cancer

Trial Results

- **471 patients** randomised 234 lap vs. 237 robotic
- **40 surgeons**
  - 29 sites, 10 countries
  - 2017 Published in JAMA

Primary end-point

- Observed conversion rate lower following robotic surgery
- No statistically significant evidence of Robotic superiority compared to laparoscopic surgery

Secondary end-points

Short-term oncological outcomes

- Similar observed rates in CRM positivity

Short-term postoperative outcomes

- Similar observed rates of 30-day complications & mortality

JAMA 2017

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Future: MIS & Robotic Colon Cancer Surgery

- Same Day Colectomy
- AI
- Micro/Mini Robots

ERP Benefits

- ERPs associated with
  - Reduced LOS
  - Up to 50% reduction in surgical complications
  - Lower readmission rates
  - Early Return of Bowel function (ROBF)
  - Reduced deconditioning
  - Earlier return to work
  - Higher patient satisfaction
  - Reduced Health Care/Hospital costs & utilization
  - Colorectal cancer pts.- earlier initiation of adjuvant chemotherapy
    - Higher 5-year overall survival

- Key elements to successful implementation: Multidisciplinary collaboration and a quality-focused culture

McLemore Et al. Same day discharge following elective, minimally invasive, colorectal [illegible]. Surgical Endoscopy. Sept 2022

Enhanced Recovery after Surgery (ERAS) Protocol Initiative Next Day Colectomy

Pre

- Patient Education
- Optimization
- Nutrition
- Multimodal Analgesia
  - Regional Anesthesia
  - Tylenol
  - Celebrex
  - Lyrica
- Standardized Booking Sheets (evidence based)

Intra

- Opioid Free Anesthesia
- Lidocaine infusion
- Normothermia
- Normoglycemia
- Individualized goal directed fluid administration

Post

- Standardized Order Sets
- Standardized DC Instructions
- Multimodal Analgesia
- Minimize Opiates
  - Tylenol
  - Lidoderm Patch
  - Celebrex/Toradol
  - Lyrica
  - Ultram prn
  - PONV mgmt
- Early PO intake
- Early Mobilization

Communication is Key!

Preoperative: Patient Education

- Preop testing- ERAS Visit
  - Nursing, APPs
  - Review what to expect preop, DOS, at home

- Clear Preop/Postop Instructions Reviewed and copy given
- Mechanical (Nulytely or GoLytely) & Antibiotic bowel prep
  - Neomycin 1 g x 3 doses
  - Flagyl 500 mg x3 doses
  - At 13:00, 14:00, 23:00
- Carbohydrate drink 2 h before induction
- Ostomy Teaching + avoiding dehydration

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Surgical Site Infection (SSI) Prevention Bundle for Elective colorectal resection

Pre-Hospital	Preoperative	Intraoperative	Postoperative
❑ Education ❑ Chlorhexidine Shower ❑ Smoking Cessation ❑ Malnutrition ❑ Glycemic Control ❑ Mechanical and Antibiotic bowel prep when appropriate	❑ Hair removal with clippers ❑ Appropriate choice, dose and timing of ABX ❑ Alcohol based skin prep. (allow to dry)	❑ Appropriately minimize catheters and drains ❑ Facial wound protectors when appropriate ❑ Dedicated wound closure trays ❑ Normothermia ❑ Meticulous hemostasis ❑ ABX redosing for longer surgical times	❑ Sterile occlusive dressing x 48h ❑ Daily wound inspection ❑ Continue euglycemia and normothermia maintenance ❑ Specific wound instructions to patients

Opioid Free Ansethesia (OFA) Colorectal Surgery Protocol

Preoperative Medications:

Agent	Dose	Timing
Lyrica	75mg PO	At least 2 hours prior to OR
Celebrex	400mg PO	At least 2 hours prior to OR
Tylenol	975mg PO	At least 2 hours prior to OR
Versed	1-2mg IV	Before PNB Block
Ropivacaine 0.25%	60 cc	During PNB

Antiemetics:

Agent	Dose	Timing
Pepcid	20mg	After Induction
Reglan	5mg	After Induction
Decadron	10mg (4mg w/ diabetics)	After Induction
Zofran	4mg	After Induction Repeat on Emergence

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OFA Colorectal Surgery Protocol

Maintenance Anesthetics:

Agent	Dose	Timing
Propofol	75mcg/kg/minute (AdBW)	Off at deep closure
Sevoflurane	0.5-1 MAC (titrate to hemodynamic response)	Off at superficial closure

Maintenance Analgesics:

Agent	Dose	Timing
Lidocaine	1.5-2mg/kg/hour (AdBW)	Off at deep closure
Magnesium	7-8mg/kg/hour (AdBW)	Off at deep closure
Ketamine	0.25-0.3mg/kg/hour (AdBW)	Off at deep closure
Esmolol	0.25-0.3mg/kg/hour (AdBW)	Off at deep closure
Dexmedetomidine	0.25-0.3mcg/kg/hour (AdBW)	Off at deep closure

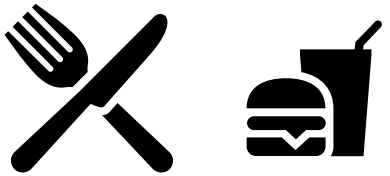
Maintenance Paralytic/ Reversal:

Agent	Dose	Timing
Rocuronium	0.5mg/kg (IBW)	2/4 TOF
Sugammadex	2mg/kg (AdBW)	During Superficial Closure

Postoperative Floor & Home Management

- Regular Diet Dinner POD 0
- IVF Stopped
- Early and Frequent Ambulation

- PO Tylenol Q6-8h
- Celebrex 200 mg BID
  - Held in CRI, PUD, CD
- Lyrica 75 mg BID (Gabapentin if insurance does not cover)
  - Held >Age 70
- Tramadol 25/50 mg Q6 prn BT pain (most do not need; Rx 10-15 tabs)
  - Other protocols use: Oxycodone, hydromorphone prn
- Lidoderm 4% patch
- Ice packs



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OFA Colorectal Surgery Protocol

Post-Operative Medications:

Agent	Dose	Timing
Tramadol	25 mg PO	Q6hrs PRN Pain Score 4-6
Tramadol	50 mg PO	Q6hrs PRN Pain Score 7-10
Simethicone	80mg PRN	Complaints of referred pain from insufflation
Ofirmev	1000mg IV Once	6 hours after Pre-Operative Tylenol dose
Lyrica	75mg PO	Twice Daily
Celebrex	400mg PO	Once Daily
Tylenol	650mg PO	Q6hrs after Ofirmev dose

Abbreviations: Minimum Alveolar Concentration (MAC), Ideal Body Weight (IBW), Adjusted Body Weight (AdBW), Per Os (PO), Pro Re Nata (PRN), Train of Four (TOF), Intravenous (IV)

In Summary

Robotics in Colon Cancer Surgery

- Improved Quality
- Safe & Feasible
- ICA allows smaller extraction incisions (2-3 cm pfannenstiel)
- Less hernia risk, Improved Cosmesis
- Less postop pain – less narcotic requirements
- Faster return of bowel function
- Shorter LOS – Next Day (Same day) Colectomy
- Lower Conversion rates

- Complications, Function, QOL similar if not better
- Potentially less Ureteral Injuries & Leaks (Firefly/ICG)
- Improved Patient Satisfaction

Larson 2005 Dis Colon Rectum, 2006 Ann Surg

Thank you

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